CASIO COMPUTER CO., LTD.

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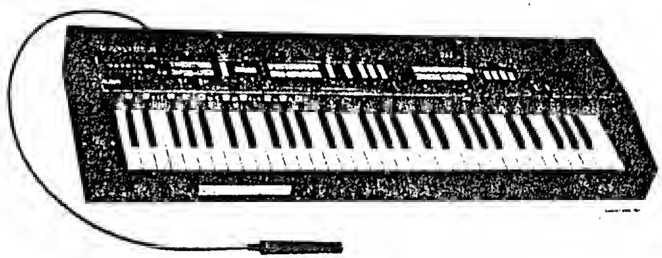
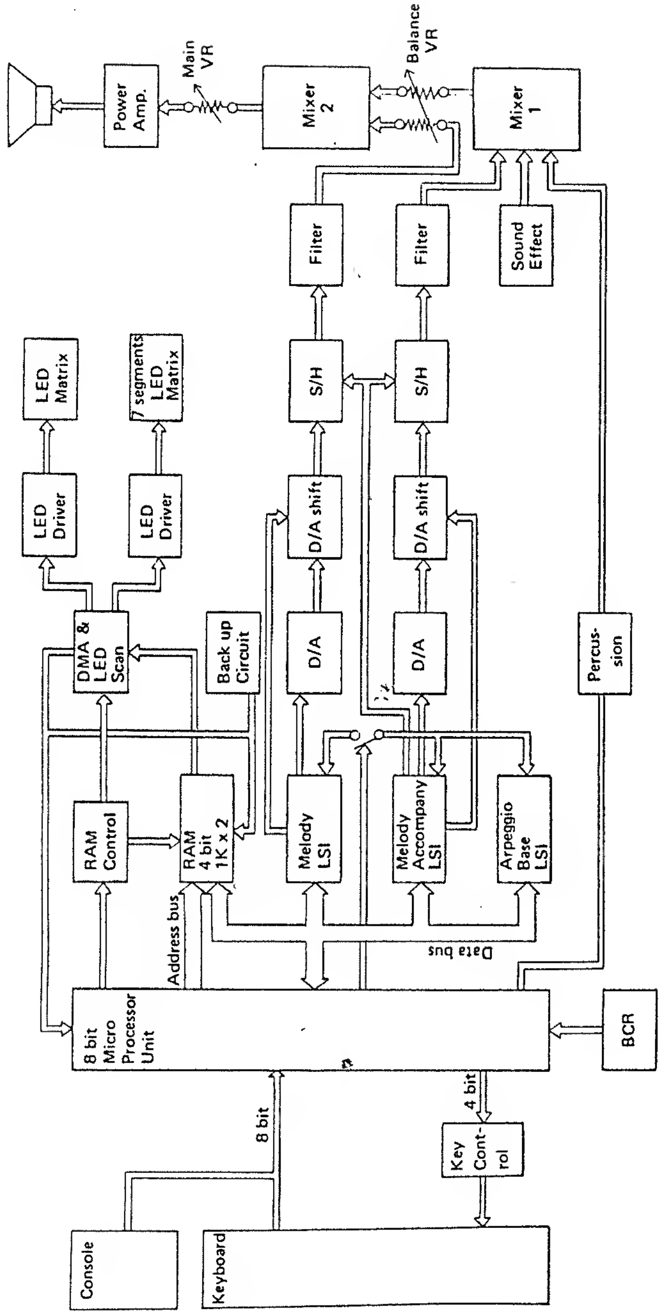
# TEXTBOOK

## Casiotone
## 701
## 601



CASIO®

## 1. BLOCK DIAGRAM






## 2. BASIC SYSTEM

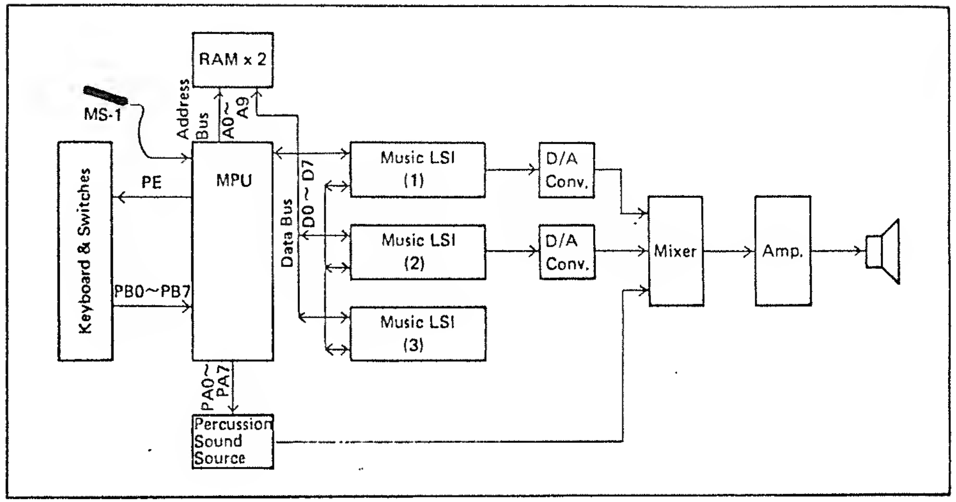



Fig. 2-1 GENERAL SYSTEM DIAGRAM

Fig. 2-1 shows a general system diagram of Casiotone 701.
The MPU (Micro Processing Unit) discriminates key and switch input and sends signals to the Music LSI's through the data bus line.

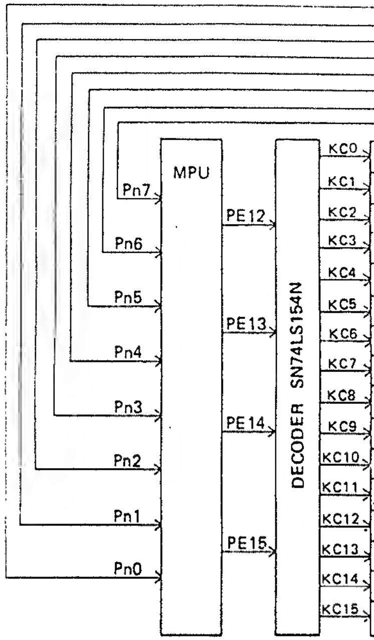
Data from the MPU is converted to digital sound signal by the Music LSI's, the Music LSI (1) and (2) generate melody sound and the LSI (3) is for base and accompaniment sounds.
Digital sound signals generated by the Music LSI's are converted into analog signals by the D/A converter.

MPU also generates timing signal for each percussion sound and the timing signal is converted into sound waveform by the Percussion Sound Source circuit.

All the melody, accompaniment, base and percussion sound signals are combined in the Mixer.

RAM (Random Access Memory) stores digital data which are written by the MS-1.

## 3. KEYBOARD CONTROL




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KC0 | ROCK | MARCH | C1 | C1# | 01 | D1# | E1 | F1 |
| KC1 | DISCO | WALTZ | F1# | G1 | G1# | A1 | A1# | B1 |
| KC2 | SWING I | RHUMBA | C2 | C2# | D2 | D2# | E2 | F2 |
| KC3 | BOSSA NOVA | TANGO | F2# | G2 | G2# | A2 | A2# | B2 |
| KC4 | RHYTHM SELECT | VIBRATO ON/OFF | C3 | C3# | D3 | O3# | E3 | F3 |
| KC5 | VIBRATO DELAY | | F3# | G3 | G3# | A3 | A3# | B3 |
| KC6 | VIBRATO SELECT | | C4 | C4# | D4 | O4# | E4 | F4 |
| KC7 | *CAC1 | *CAC2 | F4# | G4 | G4# | A4 | A4# | B4 |
| KC8 | ☆ CHORD 1 | CHORD 2 | C5 | C5# | O5 | D5# | E5 | F5 |
| KC9 | OCTAVE DOWN | MEMORY | F5# | G5 | G5# | A5 | A5# | B5 |
| KC10 | TONE SELECT | | C6 | | | | | |
| KC11 | FULL ORGAN | TIBIA | JAZZ ORGAN I | JAZZ ORGAN II | RECOR-DER | → FOR | ← BACK | OELETE |
| KC12 | ACCOR-DION | FLUTE | OBOE | FAGOTT | BRASS | RESET | REPEAT | AUTO START |
| KC13 | ACC. TONE SET | SUST. | | | RHYTHM START | SYNCH START | Fill In | ONE KEY PLAY |
| KC14 | AUTO PLAY | RECORD CHORD | RECORD MEMORY | PLAY | MUSIC SCAN. | NAVI-GATOR | | |
| KC15 | RETURN 11 | RETURN 2 | ACC. START | REST 3 | END | | | |

*

| | | CAC1 | |
|---|---|---|---|
| | | OFF | ON |
| CAC2 | OFF | OFF (NORMAL) | FING'O |
| CAC2 | ON | ON (ONE FING) | |

☆

| | | CHORD 1 | |
|---|---|---|---|
| | | OFF | ON |
| CHORD 2 | OFF | CONTIN-UOUS | RHYTH-MIC |
| CHORD 2 | ON | ARPEG-GIO | |

Fig. 3-1

4 signals PE12 ~ PE15 which are generated by the MPU (Micro Processing Unit) enter into the decoder SN74LS154N and decoded to 16 key common signals KC0 ~ KC15. Key common signals are always applied to the keyboard and by hitting one of the keys, key common signal enters a key input terminal of the MPU.
For instance, key common signal KC4 is always applied to the keyboard matrix, if D3 key is hit, signal KC4 enters into MPU through Pn4 terminal and the MPU generates the sound signal for D3.
The MPU also discriminates the positions of the switches, selected tone and selected rhythm by the same way.



## 4. MPU (Micro Processing Unit μPD7802)

μPD7802 is a 8-bit micro computer.
8y key and switch input, the MPU chooses a rhythm, a tone, or a pitch which is programmed in the internal ROM.
The following shows the purpose for each terminal of the MPU.

| PIN NO. | NAME | IN/OUT | FUNCTION |
|---|---|---|---|
| 1 | PE15 | OUT | Key common signal. |
| 2 | $\phi$ OUT | OUT | 2 MHz clock pulse output. |
| 3 ~ 10 | DB0~DB7 | IN/OUT | Data bus. 8-bit data is transferred between MPU, Music LSI's and RAM's through these lines. |
| 11 | INT 2 | IN | Tempo clock pulse input. |
| 16 | $\overline{\text{WR}}$ | OUT | While this terminal is at LOW, data is written in Music LSI or RAM through Data Bus. |
| 17 | RD | OUT | While this terminal is at LOW, MPU reads data from RAM. |
| 18 | HOLD R | IN | Hold Request signal.<br>Signal which is generated by the counter and always applied to the MPU.<br>When this signal enters, the MPU stops functioning and address bus and data bus become high impedance.*<br>*High Impedance: A status which does not accept or send data. |
| 19 | HOLD A | OUT | Hold Acknowledge signal.<br>Becomes "H" level when HOLD R signal enters into the MPU. |
| 20 | IO/$\overline{\text{M}}$ | OUT | Becomes "L" level when the MPU selects RAM's or Melody LSI's. |
| 21 | TIM 0 | OUT | Cut the data transfer between the Melody LSI's |
| 22 | SAC | OUT | Signal to light the tempo LED. |
| 23 | $\overline{\text{SCS}}$ | IN | Input signal from BCR (Bar Code Reader) MS-1. |
| 29 | $\overline{\text{RESET}}$ | IN | Schmitt trigger (which initializes the internal circuit of the MPU) input terminal. |

| PIN NO. | NAME | IN/OUT | FUNCTION |
|---|---|---|---|
| 33 ~ 39 | PA0 ~ PA6 | OUT | Percussion signals outputs.<br>PA0 . . . . . Snare drum<br>PA1 . . . . . Bass drum<br>PA2 . . . . . High conga<br>PA3 . . . . . Low conga<br>PA4 . . . . . Rim shot (claves)<br>PA5 . . . . . Hi-hat<br>PA6 . . . . . Cymbal |
| 40 | PA7 | OUT | Accompaniment start signal output. |
| 41 ~ 48 | PB0 ~ PB7 | IN | Key and switch input terminals. |
| 49 ~ 58 | A0 ~ A9 | OUT | Address bus. By the voltage levels of these terminals, data storage area is selected. |
| 59 | PE11 | OUT | Address/Data selection signal. Discriminates whether the signals DB0 ~ DB7 are data or address in the Music LSI's.<br>When this terminal is at "L" level, signals DB0 ~ DB7 become address bus in the Music LSI while they become data when PE11 is at "H". |
| 60 ~ 63 | PE12 ~ PE14 | OUT | Key and switch common signals. |



# 5. MELODY LSI (HD43517)

## 5-1. Melody LSI

The LSI generates digital sound signal from the MPU data.
Sound of each tone is made by mixing sine waves as shown Fig. 5-1.

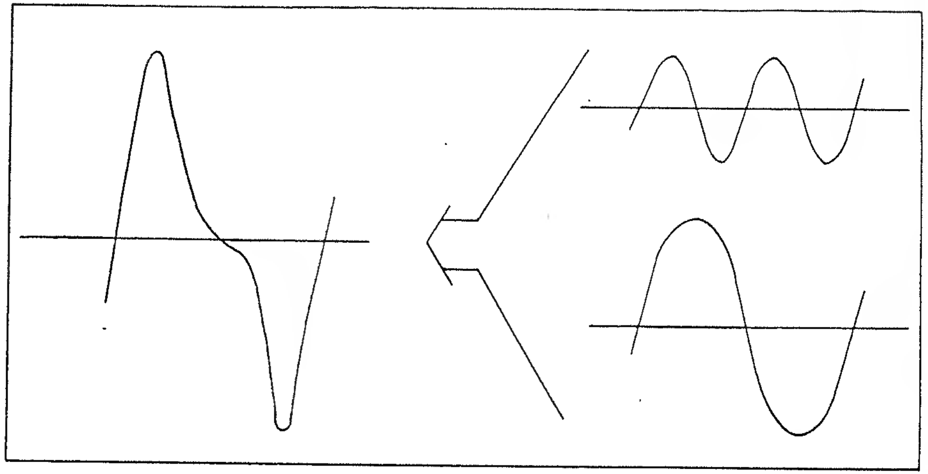


Fig. 5-1

Each LSI is 4-note polyphonic (4 notes can be sounded simultaneously).
The model employs 3 pieces of the Music LSI's, two of them are for generating melody and one LSI is for bass and accompaniment sounds.
The following lists the purpose of each terminal of the Melody LSI's.

| PIN NO. | NAME | IN/OUT | FUNCTION |
|---|---|---|---|
| 1 ~ 8 | DB0 ~ DB7 | IN | Data input from the MPU. |
| 9 | DAD | OUT | Output of serial data of digital sound signal.<br>Through this terminal, data is transferred between the Musci LSI's. |
| 10 | SYNC | IN/OUT | For synchronization between the Music LSI's. |
| 11 | EVD | IN/OUT | Envelope data serial output.<br>Data transferring way is from slave chip to master chip. |

| PIN NO. | NAME | IN/OUT | FUNCTION |
|---|---|---|---|
| 12 | CS | IN | Chip select terminal. While this terminal is at "H", the LSI reads data at the timing of signal $\overline{WE}$. The read data is kept in the LSI when signal CS is at "L" level. |
| 13 | $\overline{WE}$ | IN | Write enable signal. While this terminal is at "L" level, data is read into the LSI through the data bus. |
| 14 | $\overline{A}$/D | IN | Address-Data selection signal. As the data bus functions as the address selection in the Music LSI, the signal discriminates whether the bus line is a data or for address selection. When this terminal is at "L" level, data bus selects address while the data bus becomes data when this terminal is at "H" level. |
| 18 | MSO | IN | Master-Slave selection signal. By receiving a signal from the MPU, the three Music LSI's discriminates which one will have priority. |
| 19 | $\overline{RES}$ | IN | Input terminal of schmitt trigger signal which initializes the internal circuit of the LSI. |
| 20 | CLOCK | IN | 4 MHz clock pulse input terminal. |
| 22 ~ 34 | DA0 ~ DA12 | OUT | Digital output from the Music LSI. |
| 35 ~ 37 | DAS0 ~ DAS2 | OUT | D/A shift output terminals. |
| 38 | S/H | OUT | Sample and Hold signal output terminal. |



## 6. SOUND CONTROL CIRCUITS

Fig. 6-1 shows a block diagram of sound control circuits.

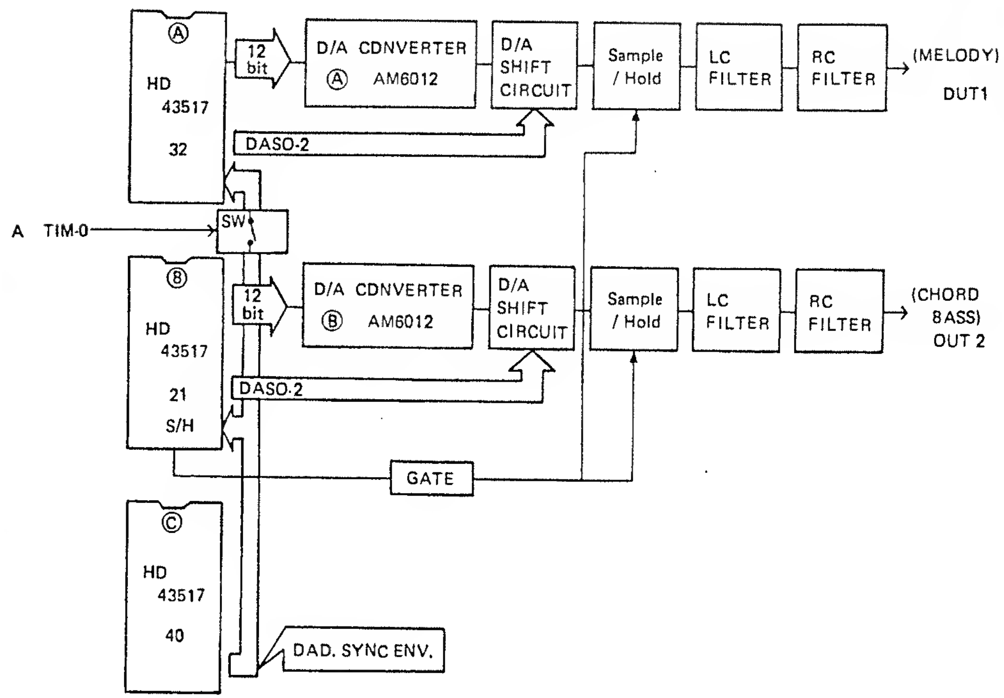



Fig. 6-1

Music LSI's . . . generate digital sound signal from MPU data.

In accordance with the position of CASIO CHORD select lever, digital signals for melody and accompaniments (chord and bass) appear from DA1 ~ DA12 terminals of the LSI.

The following is major functions of each LSI.

LSI Ⓐ (HD43517-32) : Melody
LSI Ⓑ (HD43517-21) : Chord
LSI Ⓒ (HD43517-40) : Bass

A. CASIO CHORD switch OFF (8-note polyphonic melody)

The control switch SW turns on by the signal TIM-0 from the MPU so that the digital sound signal (DAD), envelope signal (ENV) are sent in serial from LSI Ⓑ and Ⓒ to LSI Ⓐ. The sound signals DA1 ~ DA12 appear from the LSI Ⓐ.

B. CASIO CHORD switch ON or FINGERED (4-note polyphonic melody, 4-note polyphonic chord and bass).
The control switch SW is turned off so that the signals DAD, ENV, SYNC from LSI's Ⓑ and Ⓒ cannot enter into the LSI Ⓐ.
The LSI Ⓐ generates 4-note polyphonic melody. The LSI Ⓑ produces chord and bass (which is generated in the LSI Ⓒ and sent to the LSI B through DAD, ENV signals).

D/A converter ......... Turns digital outputs of the Music LSI's into an analog waveform. The D/A converter Ⓐ generates melody while the converter Ⓑ produces chord and base waveforms.

D/A shift ............. In order to obtain a smooth reducing sound, the block changes the output level of the D/A converter.

Sample/Hold circuit..... Removes glitch noise.

LC & RC filters ........ Cut unnecessary frequency.

## 6-1. D/A (CONVERTER (AM6012DC) )

As the output of Music LSI's is 12-bit digital signal, D/A (Digital to Analog) converter changes digital input data to corresponding analog signal values (amount of current).

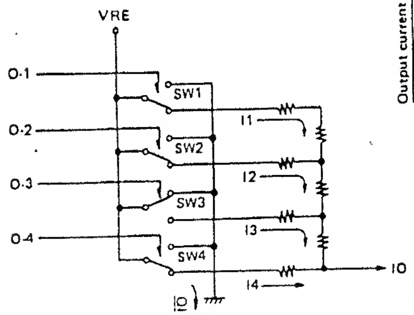



Fig. 6-2 4-bit D/A converter

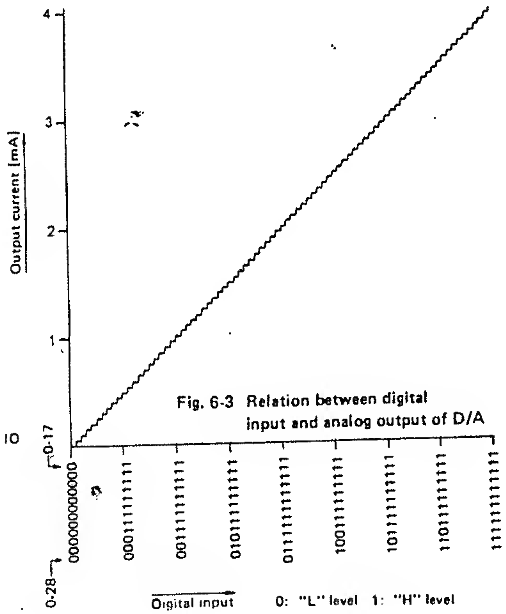



Fig. 6-3 Relation between digital input and analog output of D/A



Fig. 6-2 shows the fundamental of 4-bit D/A converter.
Current I1 ~ I4 flow if the switches SW1 ~ SW4 are ON.
The electronic switches SW1 ~ SW4 turn on or off by the voltage levels of digital signals O-1 ~ O-4. If all the switches are turned on, the output current IO will be;

$$IO = I1 + I2 + I3 + I4$$

Thus, digital signal is converted to analog amount of current.

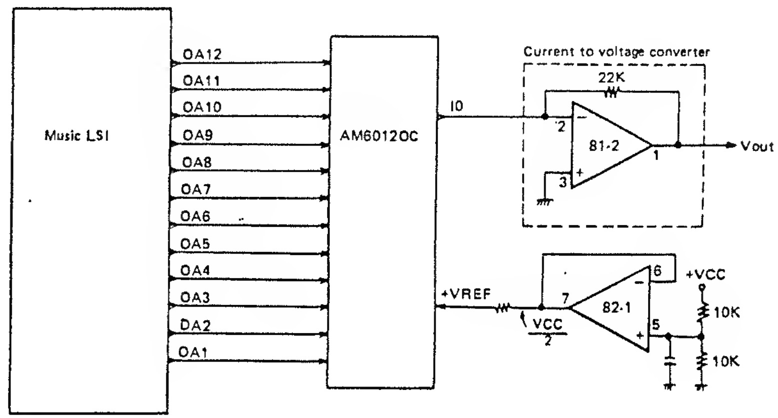
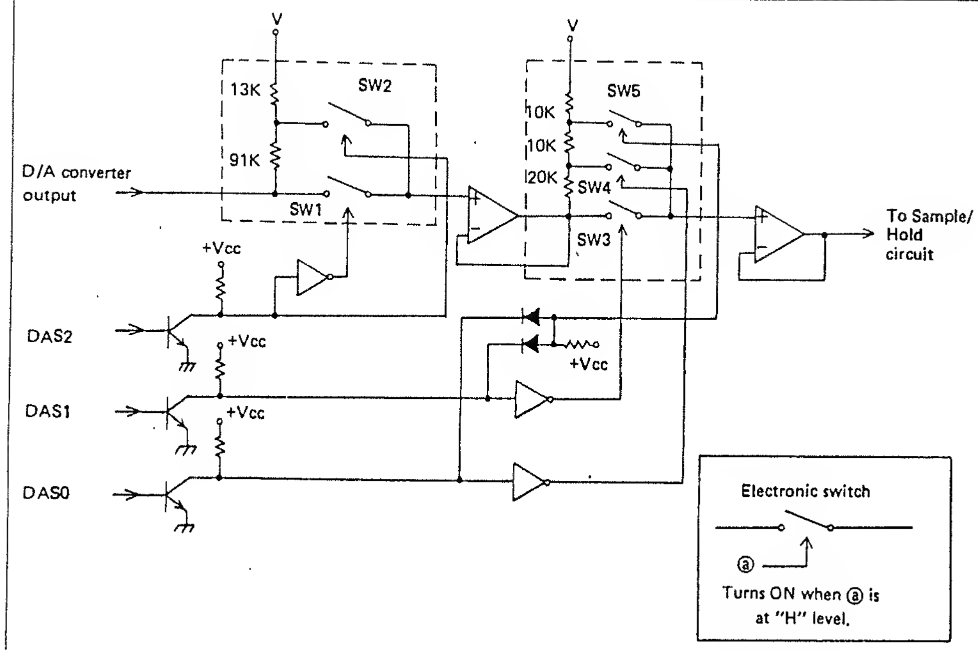



Fig. 6-4 D/A converter block

## 6-2. D/A SHIFT CIRCUIT

The circuit changes the output level of the D/A converter in order to obtain a smooth reducing envelope. By turning electronic switches SW1 ~ SW5 ON or OFF, the output voltage level of the D/A converter reduces.
The switches SW1 ~ SW5 are closed or opened by the signals DAS0, DAS1 and DAS2.




| DAS2 | DAS1 | DAS0 | SW1 | SW2 | SW3 | SW4 | SW5 | LEVEL |
|---|---|---|---|---|---|---|---|---|
| H | H | L | ON | OFF | ON | OFF | OFF | 1 |
| H | L | H | ON | OFF | OFF | ON | OFF | 1/2 |
| H | L | L | ON | OFF | OFF | OFF | ON | 1/4 |
| L | H | L | OFF | ON | ON | OFF | OFF | 1/8 |
| L | L | H | OFF | ON | OFF | ON | OFF | 1/16 |
| L | L | L | OFF | ON | OFF | OFF | ON | 1/32 |

Fig. 6-5

Examples

(A) To reduce the level 1/8

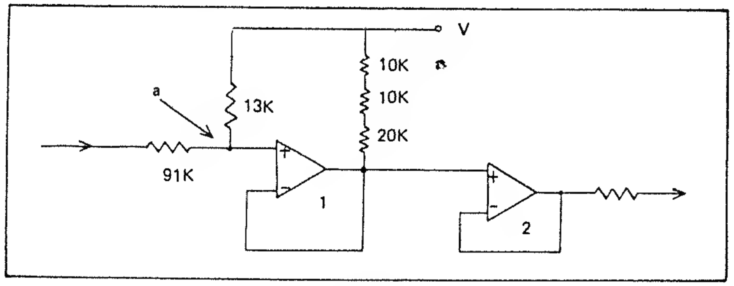



Fig. 6-6

When the voltage levels of the signals DAS0, DAS1 and DAS2 from the Music LSI are "L", "H", "L" respectively, switches SW2 and SW3 turn on. The equivalent circuit is shown above.

The voltage level of point ⓐ is . . .

$$\frac{13k}{91k + 13k} V = \frac{1}{8} V$$

Thus the voltage level is reduced in 1/8.

(B) To reduce the level in 1/32

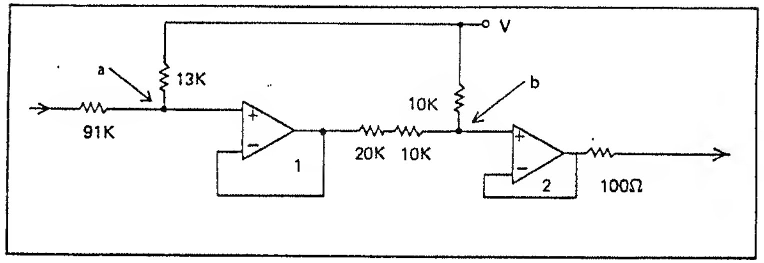



Fig. 6-7

When the signals DAS0, DAS1 and DAS2 are at "L" level, SW2 and SW5 turn ON. Fig. 6-7 shows the equivalent circuit.

As formerly explained, the voltage level of point ⓐ is 1/8.

Voltage level of the point ⓑ is . . .

$$\frac{10k}{10k + 10k + 20k} V = \frac{1}{4} V$$

As 1/8 reduced signal is further reduced in 1/4, the output level of the OP amp ② is . . .

$$\frac{1}{8} \times \frac{1}{4} = \frac{1}{32}$$

Thus the voltage level is reduced in 1/32.

## 6-3. Sample/Hold Circuit

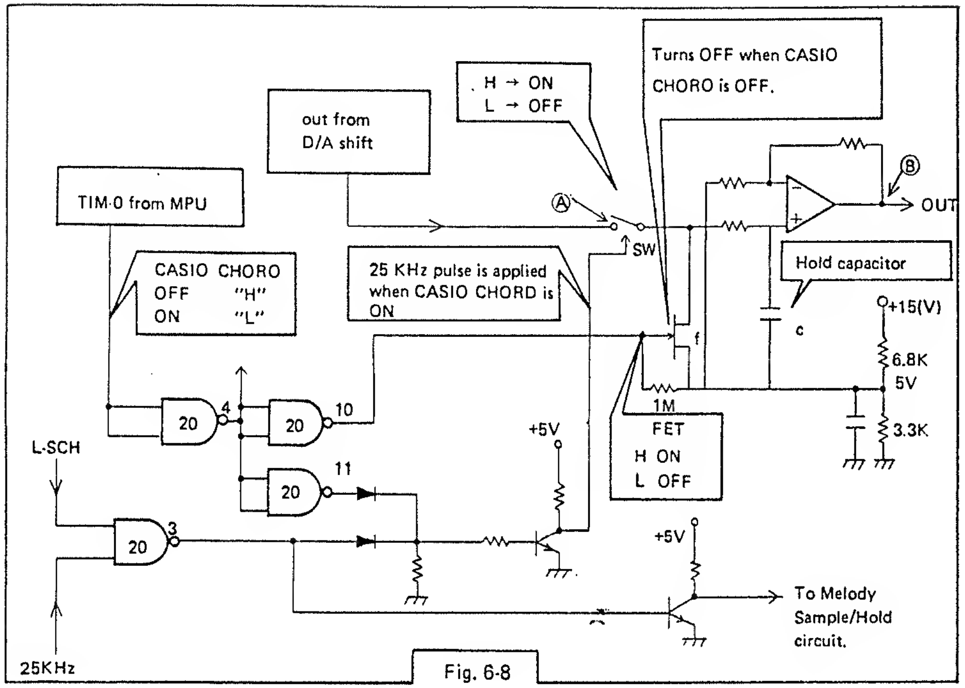



Fig. 6-8

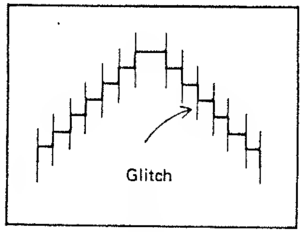



Fig. 6-9

Output of the D/A converter is a stepped waveform as shown in Fig. 6-9. The output waveform involves spike noises, called glitches, generated as the digital input of the D/A converter varies.

The function of the Sample/Hold circuit is to remove the glitch noise.

Fig. 6-8 shows the Sample/Hold circuit for chord and bass.

As the frequency of one step of D/A converter output is 25 KHz, 25 KHz pulse is applied to the electronic switch SW.

The switch SW turns OFF at the time glitch be generated. While the switch is OFF, input voltage of the OP amp is supplied by discharging of the hold capacitor c.

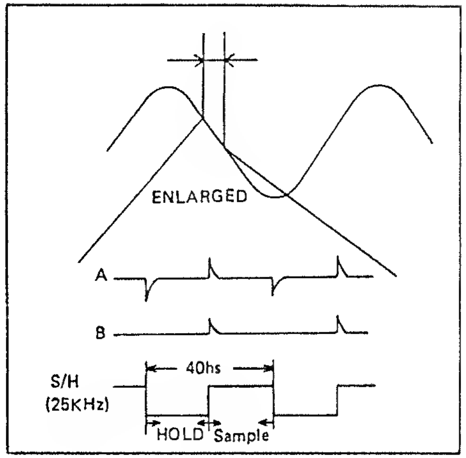



Fig. 6-10

The FET f cuts the output of D/A converter when CASIO CHORD switch is OFF so that accompaniment signal is not sounded.

## 6-4. Filter

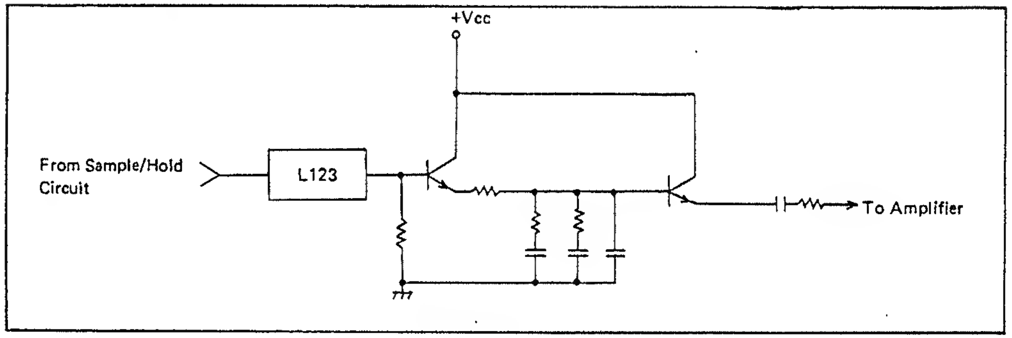



Fig. 6-11

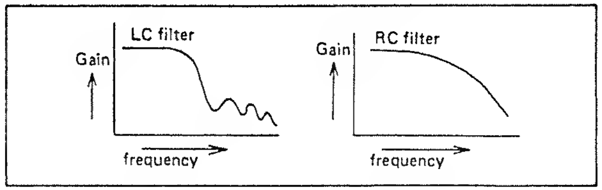
The functions of filter is . . .

(A) Waveform shaping.
By passing through a filter, stepped waveform is shaped smoothly.

(B) Removing noises.

(C) Cut unnecessary frequencies.

In Fig. 6-11, the box L123 is LC filter which is composed of a coil and capacitors while the resistors and capacitors constitute a RC filter. Fig. 6-12 shows frequency responses of LC and RC filters.



## 7. OTHER CIRCUITS

### 7-1. Rhythm Tempo Oscillator

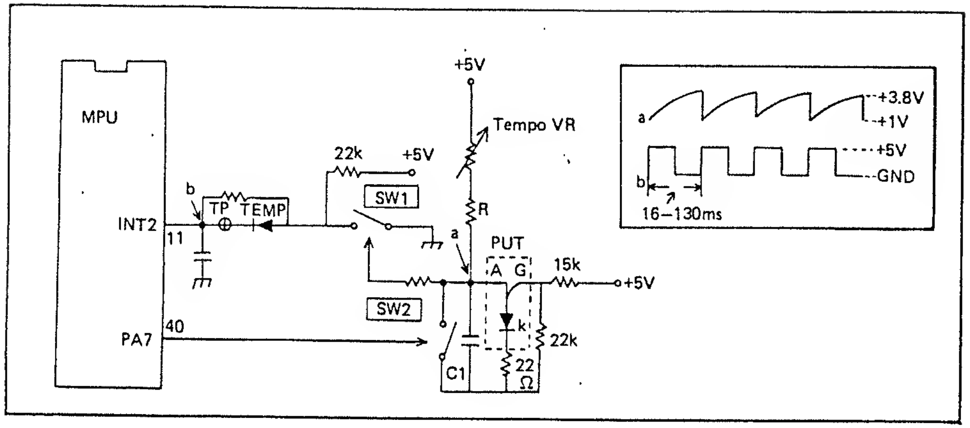



Fig. 7-1

Tempo oscillation signal is generated by a PUT (Programmable Unijunction Transistor). The capacitor C1 is charged through resistors R1 and VR, if charged voltage (equal to voltage level of PUT's anode) become higher than the gate, the PUT turns on.
When the PUT turns on, the capacitor C1 is discharged and the PUT turns OFF again. Thus tempo oscillation for accompaniment is done by turning ON or OFF of the PUT. The electronic switch SW1 turns on or off by the anode voltage of the PUT so that the pulse is shaped in square waveform. Signal PA7 from the MPU raises to "H" level in a short time at rhythm start timing. The switch SW2 turns ON so that the capacitor C1 is discharged. The rhythm starts at falling edge of signal PA7.



### 7-2. Pulse Generator

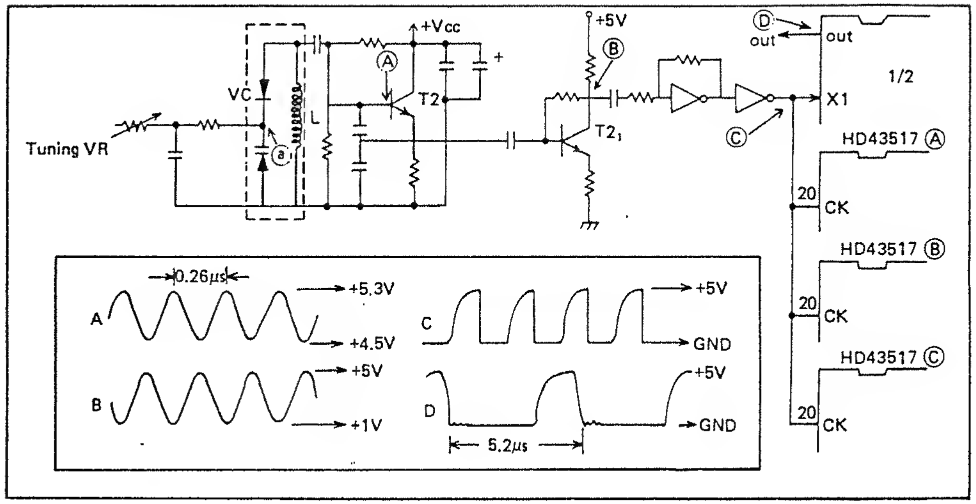



Fig. 7-2

The circuit generates clock pulse which is fundamental pulse for the LSI's.
In Fig. 7-2 within the dotted line is a resonance circuit. The resonance frequency 4 MHz depends on the inductance L and the capacitance VC.
VC is a variable capacitor whose capacity varies by the voltage at the point ⓐ. Voltage of the point ⓐ is varied by the turning VR.

### 7-3. Power Drop Detection Circuit

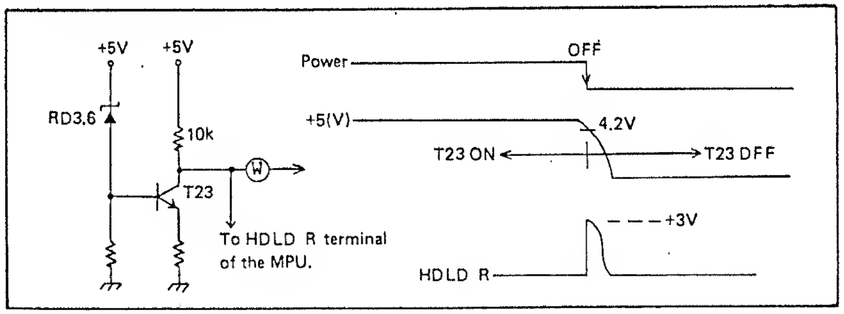



Fig. 7-3

The circuit detects the level down of +5V.
When the +5V is less than 4.2V, the transistor T23 turns off so that the signal HOLD R is generated and applied to the MPU.
By receiving signal HOLO R, MPU stops sending data to RAM's or Music LSI's in order to avoid to send misinformation.

### 7-4. Schmitt Circuit

The circuit generates schmitt trigger pulses which initialize the equipment when it is turned on. There are two kinds of schmitt trigger pulses which are L-SCH (long schmitt) and S-SCH (short schmitt).

Fig. 7-4 shows block diagram and functions of the schmitt circuit while Fig. 7-5 explains actual circuit and waveforms.

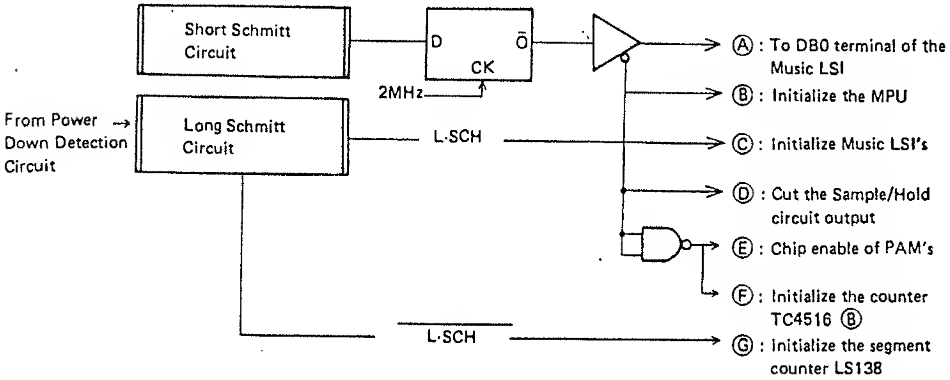



Fig. 7-4

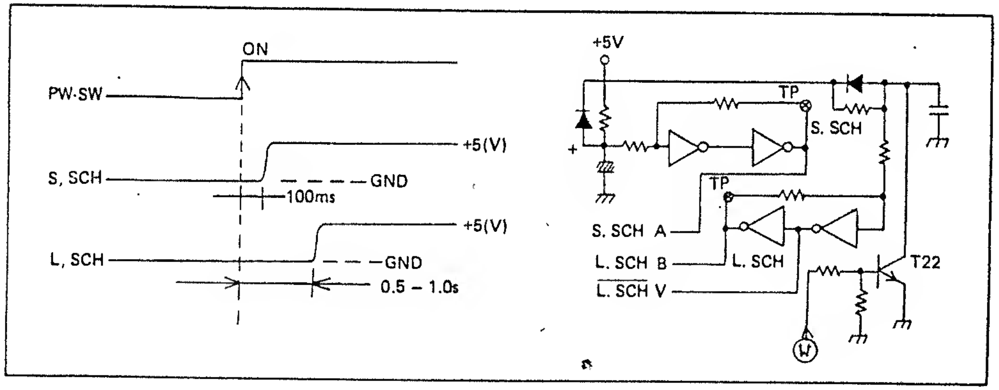



Fig. 7-5

### 7-5. LED Drive Circuit

Fig. 7-6 shows block diagram of the LED drive circuit. The counter counts up the 250 KHz pulse and sends pulse to HOLD R terminal of the MPU at certain timings.

By receiving HOLD R signal from the counter, MPU stops to select RAM address. At this time, the control gate opens so that the signals from the counter address the RAM.



Output data from the selected RAM address enters into the latch so that the data is kept for certain period. Signal from the counter also enters into the decoder which selects a LED to be lit.

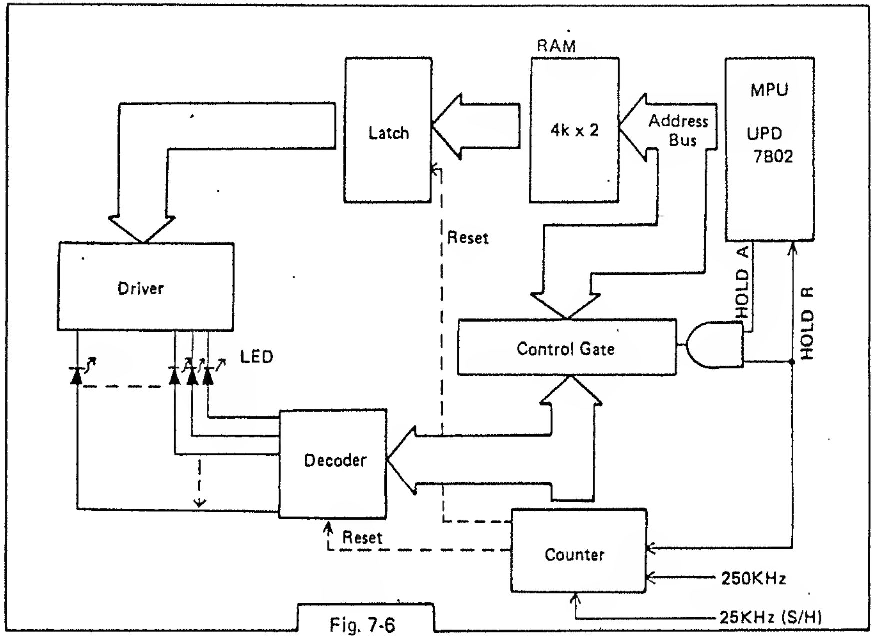



Fig. 7-6

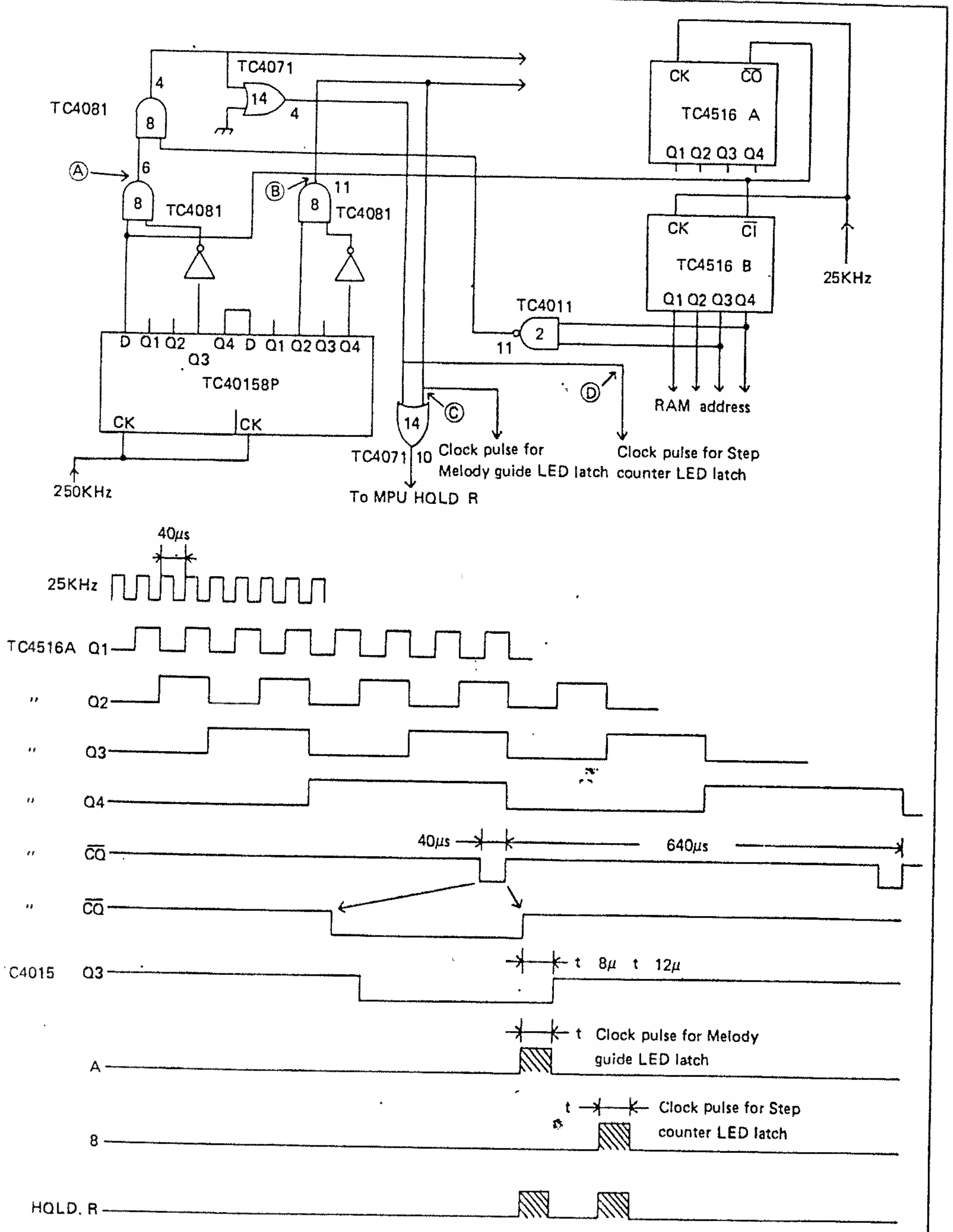
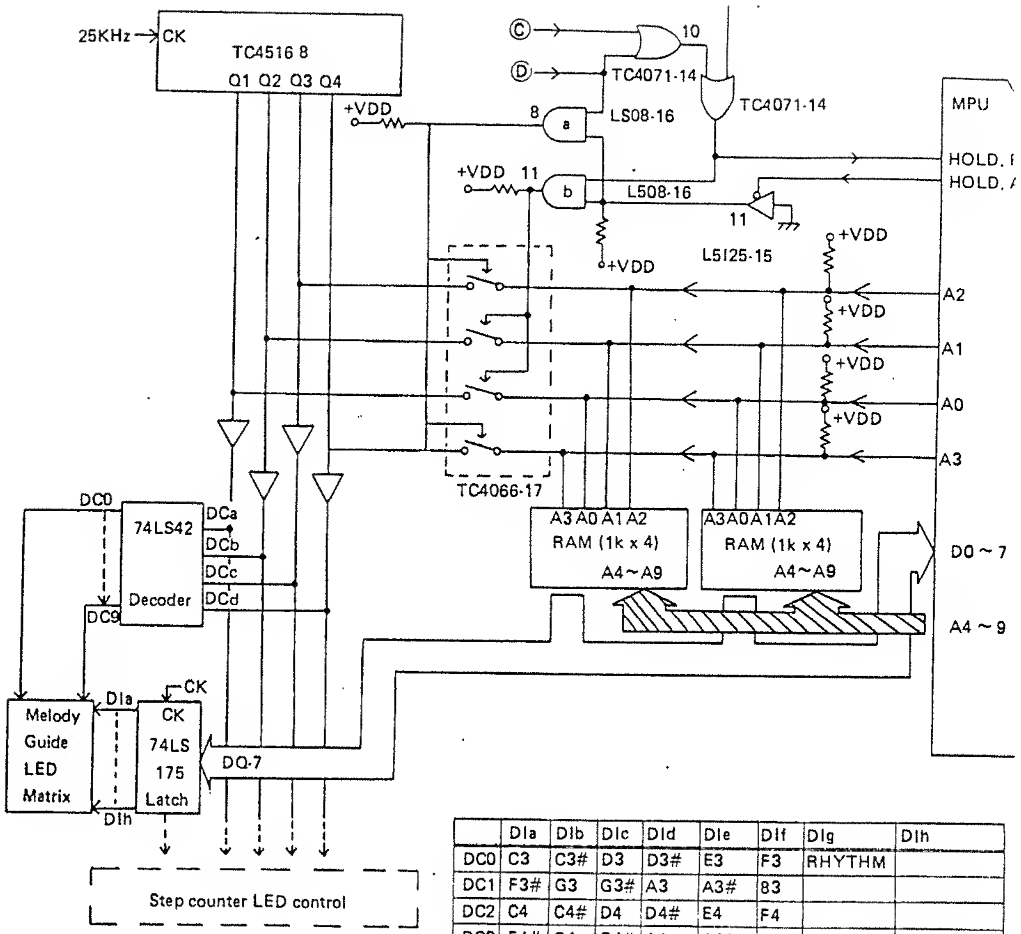



Fig. 7-7 Counter Circuit






| | Dla | Dlb | Dlc | Dld | Dle | Dlf | Dlg | Dlh |
|---|---|---|---|---|---|---|---|---|
| DC0 | C3 | C3# | D3 | D3# | E3 | F3 | RHYTHM | |
| DC1 | F3# | G3 | G3# | A3 | A3# | 83 | | |
| DC2 | C4 | C4# | D4 | D4# | E4 | F4 | | |
| DC3 | F4# | G4 | G4# | A4 | A4# | 84 | | |
| DC4 | C5 | C5# | D5 | D5# | E5 | F5 | | |
| DC5 | F5 | G5 | G5# | A5 | A5# | 85 | | |
| DC6 | C6 | | | | | | | |
| DC7 | C1 | C1# | D1 | D1# | E1 | F1 | RET 2 | RET 1 |
| DC8 | F1# | G1 | G1# | A1 | A1# | 81 | | ACC 5TART |
| DC9 | Maj | Min | 7th | Min 7 | Maj 7 | din | aug | End |

Melody Guide LED Matrix

Fig. 7-8

In Fig. 7-8, at certain timings, the counter sends HOLD R signal to the MPU. By receiving HOLD R (Hold Request) signal, the MPU becomes "HOLD" status which does not select RAM address also at the same time the MPU generates HOLD A (Hold Acknowledge) signal so that the gates a and b open. From the outputs of the gates, the electronic switches close so that the signals from the counter access the RAM address.
Signal from the counter also enters into the decoder which generates DC0 ~ DC9 signals. From the selected RAM address, data signal goes in to the latch which generates signals Dla ~ Dlh.
Fig. 7-9 shows a part of the LED matrix. For example, the LED F3# is lit by signals DC1 and Dla.

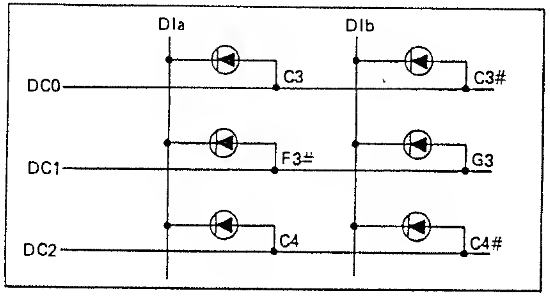



Fig. 7-9

## 7-6. Sound Effect ( ) Circuit

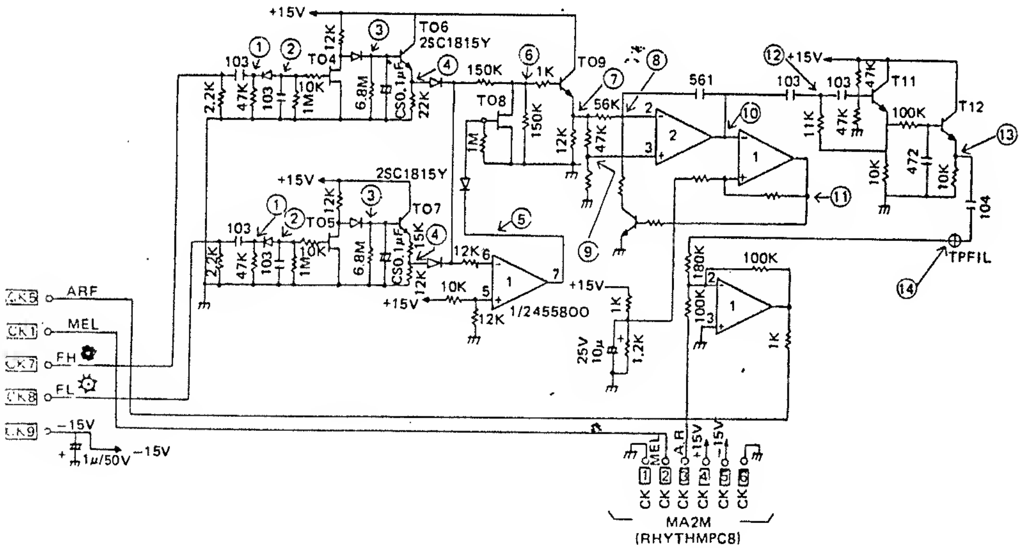



Fig. 7-10

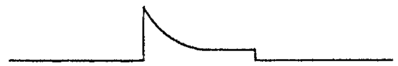


The circuit is composed of four blocks.
Block (A) . . . Generates a pulse whose voltage drops in time.

Output signal of block (A)

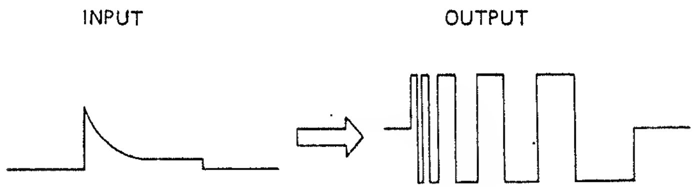
Block (B) . . . Limitter which cuts the last part of the input signal (output of block (A) )

Output signal of block (B)



Block (C) . . . VCO (Voltage Controlled Oscillator)

Generates frequencies in accordance with input voltage.




Block (D) . . . Forms VCO output signal in fading shape.

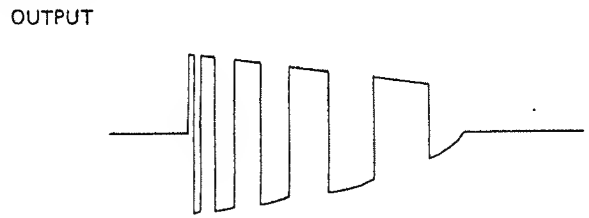



Fig. 7-11 shows the waveforms of the Sound Effect circuit.

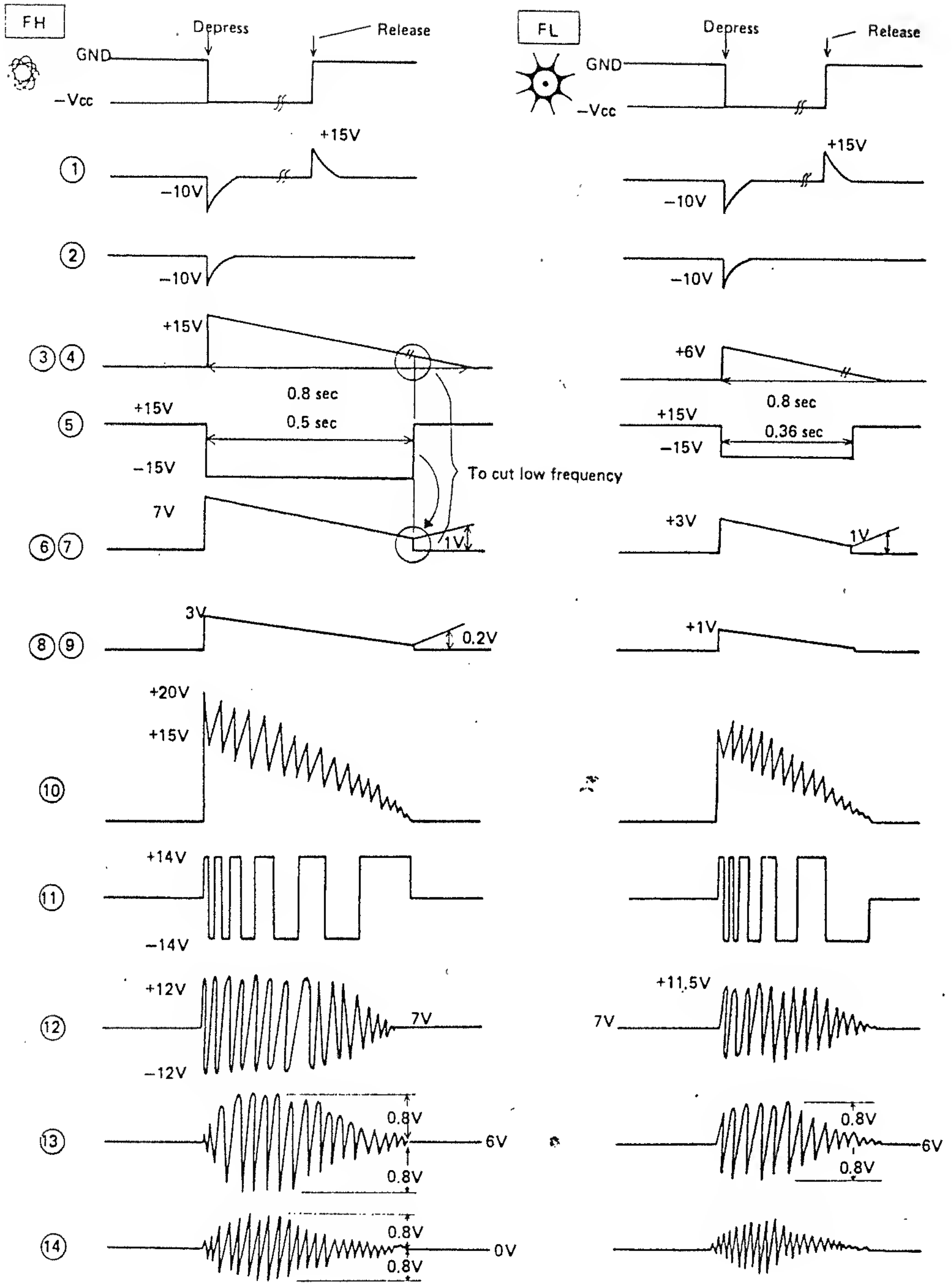


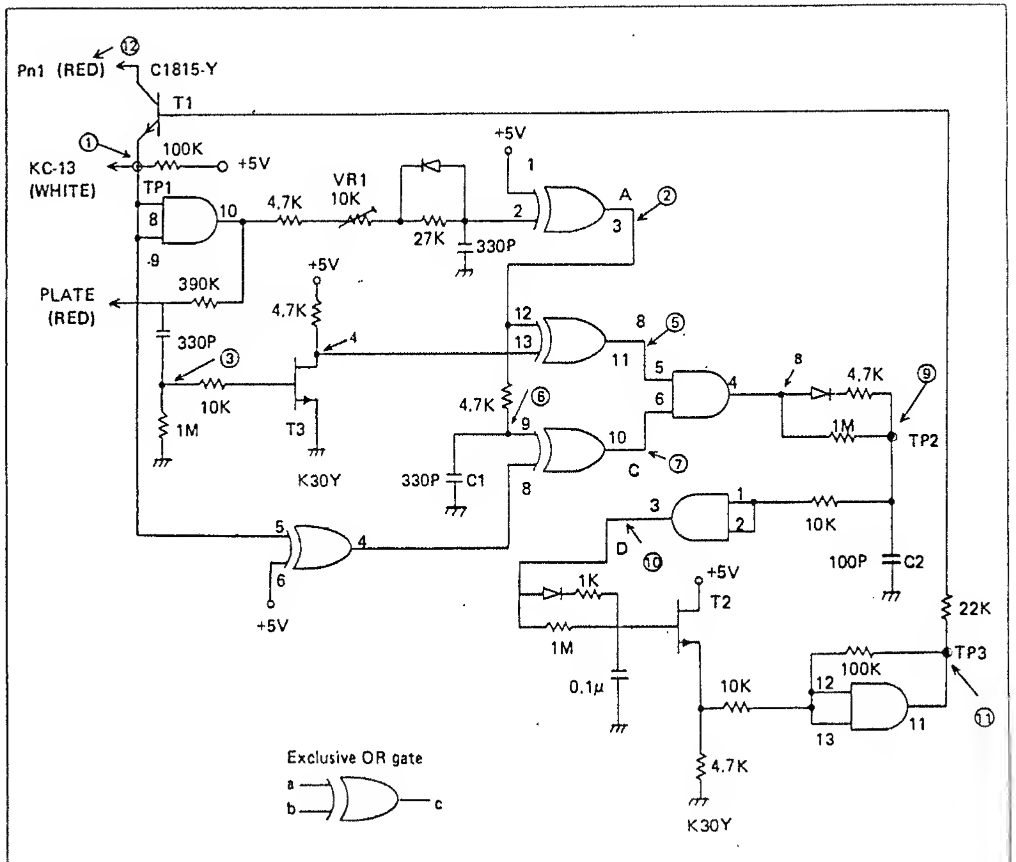

Fig. 7-11



### 7-7. Touch Sensor (FILL IN PLATE) Circuit

The MPU generates "FILL IN" rhythm by receiving KC-13 signal from Pn 1 terminal.

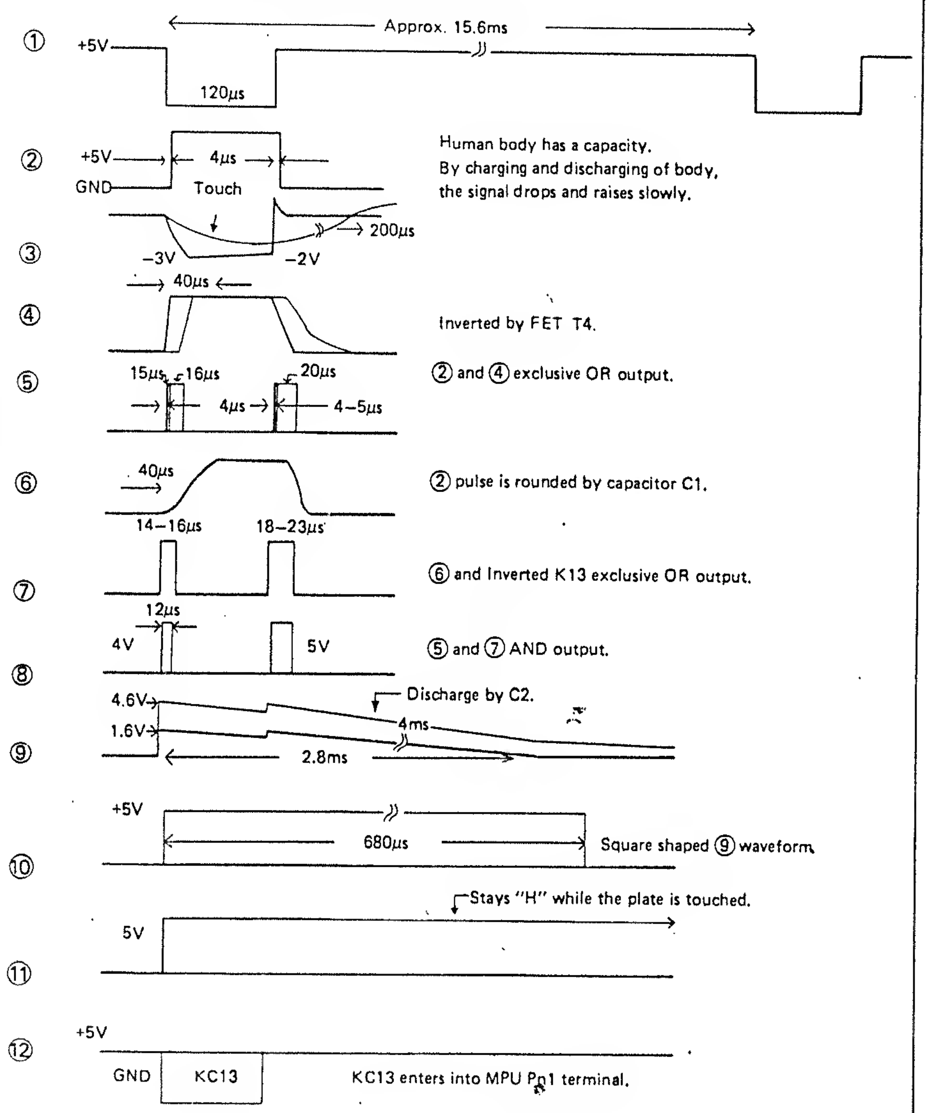
Fig. 7-12 shows the touch sensor circuit while Fig. 7-13 explains the time chart of the circuit.




| a | b | c |
|---|---|---|
| L | L | L |
| H | L | H |
| L | H | H |
| H | H | L |

Fig. 7-12

Note: Thick line: Normal
Thin line : When Fill in plate is touched




Adjustment: Adjust VR1 so that the peak of ⑨ waveform is + 4.6V.

Fig. 7-13



## 7-8. Percussion

(A) Bass drum, Snare drum, Claves, Low conga, High conga

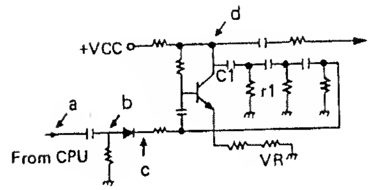



Fig. 7-14

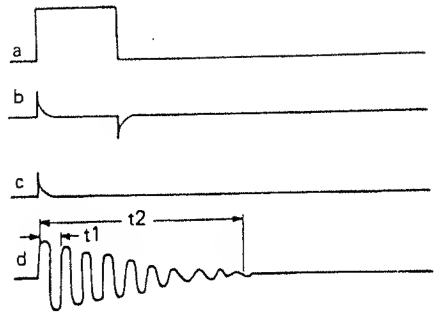



Fig. 7-15

As percussion output P11 ~ P17 from the CPU are single pulses, they should be changed to sound waveforms.

The frequency t1 is varied by the capacitor c1's and resistor r1's which are fixed in accordance with the percussion instruments.

The decreasing time t2 is varied by the variable resistor VR's.

The following shows the method of t2 adjustment.

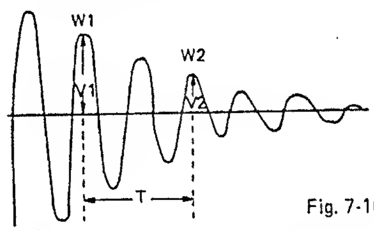



Fig. 7-16

1. Pick up any wave w1 and check its voltage v1.
2. Find a wave w2 whose voltage v2 is about half of v1.
3. Set the length T between w1 and w2 as mentioned below by turning the variable resistor VR.

| | Bass Drum | Snare Drum | Low Conga | High Conga | Claves |
|---|---|---|---|---|---|
| T | 15 m sec. | 7 m sec. | 27 m sec. | 16 m sec. | 3.9 m sec. |
| VR to adjust | VR4 | VR5 | VR3 | VR2 | VR1 |
| Check point | TP4 | TP5 | TP3 | TP2 | TP1 |

(B) Cymbal, Hi-hat, Snare drum

As those percussions have hissing sound, those sounds are created from a noise so called "white noise".

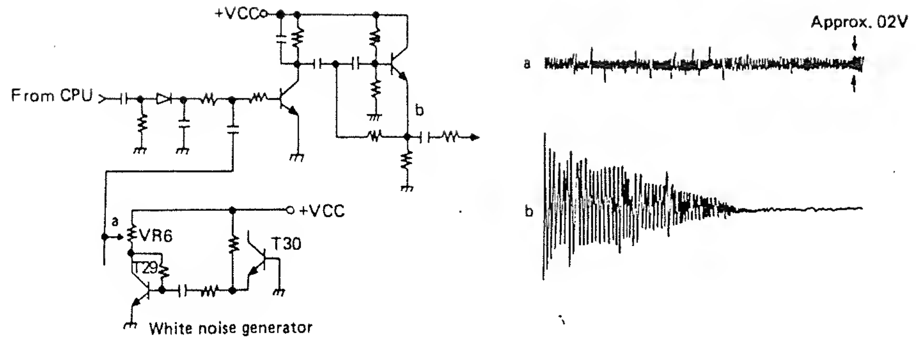



Fig. 7-17

## B. BCR (BAR CODE READER)

BCR discriminates 2 millimeter bars (black and white) as "1" while it reads 0.8 millimeter lines as "0". The followings are composition of bar coded score.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ |

1. Front dummy code : "0000"
2. Start mark : "0010"
3. Line number : "0000" to "1111"
4. Header : Exists only the first lines of the PITCH, LENGTH AND CHORD.
   PITCH : "0001"
   LENGTH : "0010"
   CHORD : "0100"
5. Data : 8 bit per one data
6. Line end mark : "1111"
7. Block end mark : Discriminates the end of each block (PITCH, LENGTH, CHORD). End "1", Not end "0"
8. Check bit : 4 bit
9. Rear dummy code :



### 8-1. BCR Circuit

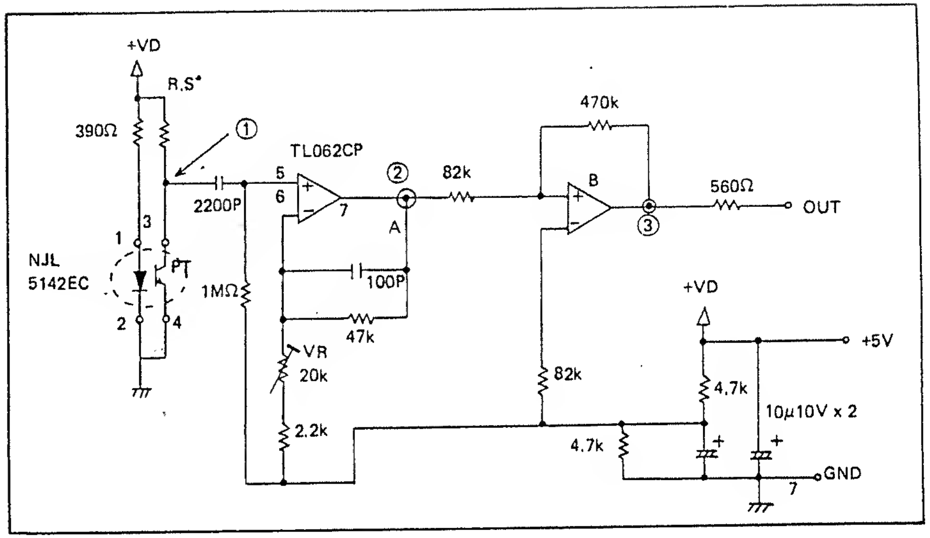



Fig. 8-1

| NJL5142EC | RS (KΩ) |
|---|---|
| B | 16 |
| C | 27 |
| D | 43 |

Fig. 8-1 shows the circuit diagram of the BCR. The resistance RS varies in accordance with the sensitivity of the photo reflector as shown left.

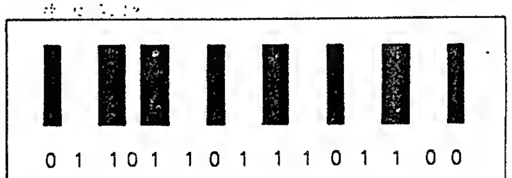



Fig. 8-2 Example for reading Bar Code.

Fig. 8-2

The phototransistor PT turns ON or OFF by the reflection of bar code (White: ON, Black: OFF).
The signal from the PT is amplified by OP amp. A and shaped by OP amp. B.

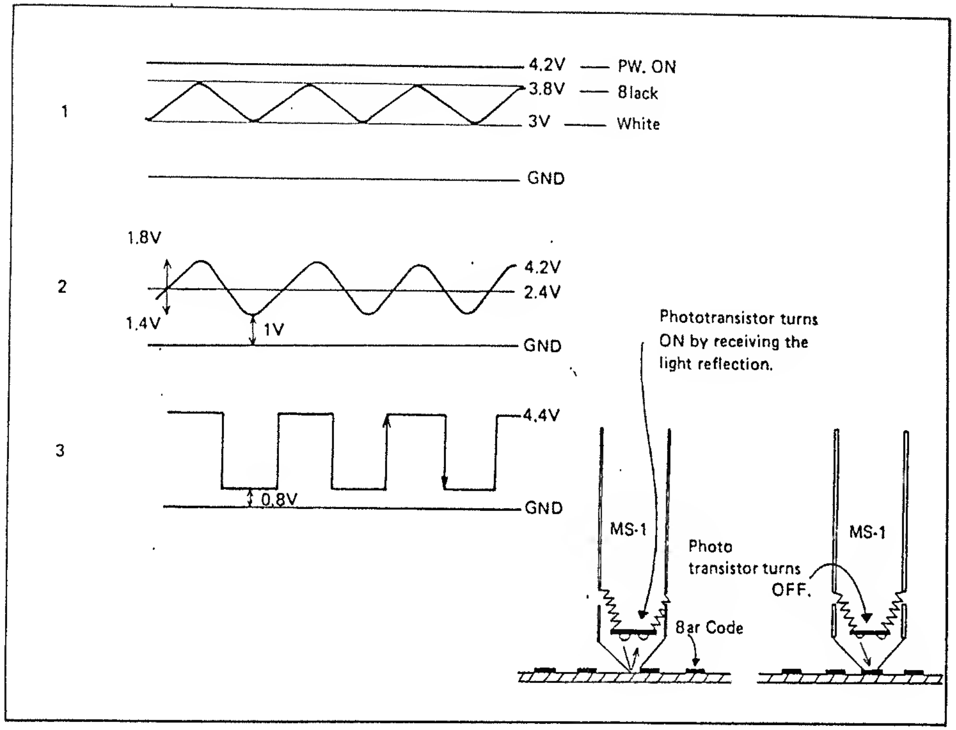
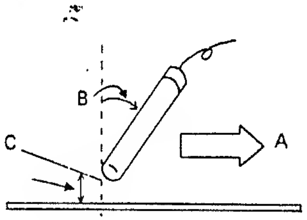



Fig. 8-3

## 8-2. BCR Specifications

- A. Sliding speed: : 10 –60cm/sec.
- B. Angle of inclination: Up to 20°
- C. Clearance gap : 0 – 0.5mm
- D. Durability of cap : 200,000 Scans




## 8-3. Adjustment

- A. Attach a prove of an oscilloscope at pin No. 7 of the OP amp. TL062CP.
- B. Scan data "00000 . . . 0" (0.8 mm stripe).
- C. Adjust the VR so that the peak voltage is 1.4 ~ 1.5 V.



1. Remove the rear cap by using a rear cap opener.

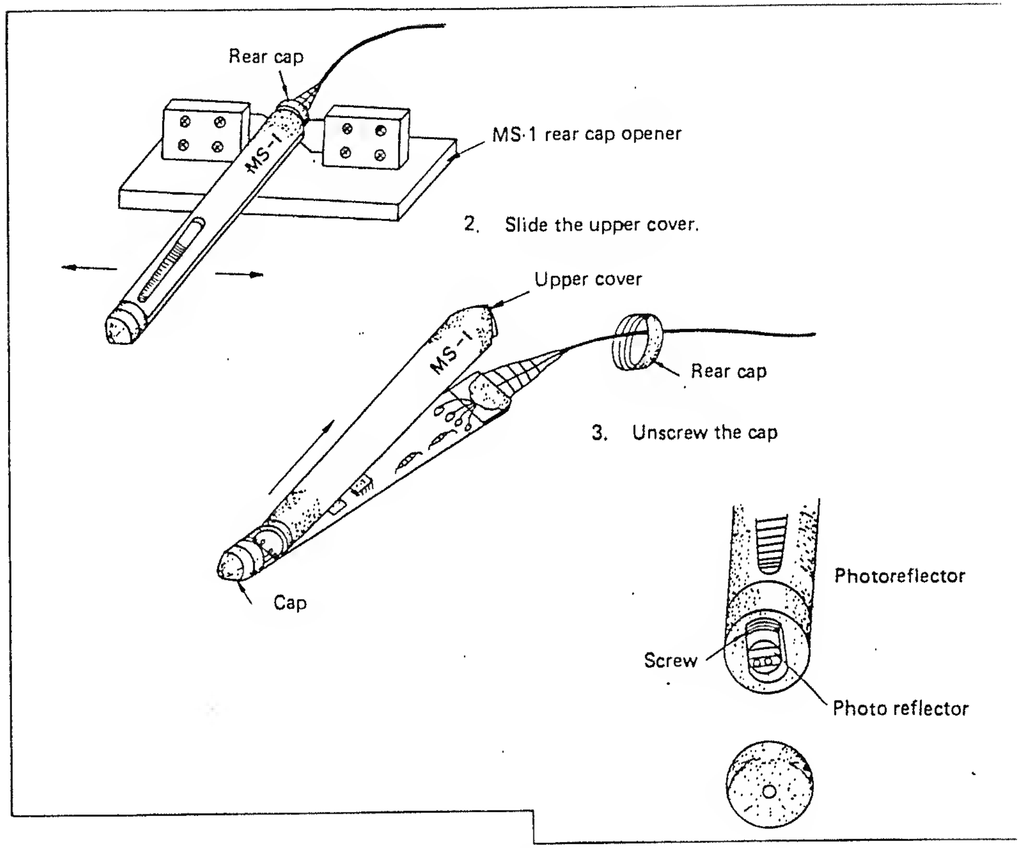
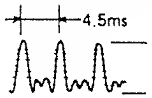
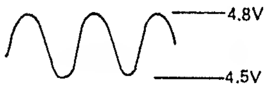
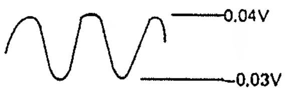



Fig. 8-4

## 9. MAJOR WAVEFORMS

### 9-1. Melody

The following waveforms can be observed when depressing key A3 continuously.

| Checkpoint | Jazz Organ 1 | Piccolo |
|---|---|---|
| Pin No. 1 of OP amp. 34 |   |   |
| Pin No. 1 of OP amp. 38 |   |   |
| Emitter of Transistor T17 |   |   |
| LINE-OUT |   Pin No. 9 of SI-1020H |   |

LINE-OUT, Jazz Organ 1:

| | L-OUT | H-OUT | SI-1020H |
|---|---|---|---|
| V1 | +0.04V | +0.5V | +2.2V |
| V2 | −0.16V | −1.3V | −5V |

LINE-OUT, Piccolo:

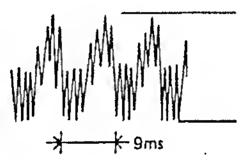
| | L-OUT | H-OUT | SI-1020H |
|---|---|---|---|
| V2 | +0.06V | +0.8V | +3.4V |
| V3 | −1.13V | −0.8V | −3.4V |

Fig. 9-1



### 9-2. Chord

Key to depress: A1
CASIO CHORD: FINGERED
RHYTHM: ISTOP Tone : Piccolo




| | V1 | V2 |
|---|---|---|
| Pin No. 1 of OP amp. 23 | 8.4V | 5.2V |
| Pin No. 1 of OP amp. 37 | 2V | 4.4V |

Emitter of transistor T19

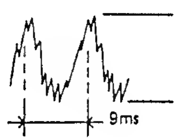



Fig. 9-2